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APPLICATION FOR PATENT

ON

RF CONTROLLED EMERGENCY STOP

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RF CONTROLLED EMERGENCY STOP

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This is a non-provisional application claiming priority to U.S. Provisional Patent Application Serial No. 60/428,371, filed November 22, 2002, herein incorporated by reference in the entirety.

FIELD OF THE INVENTION

[0002] The present invention generally relates to the field of supplying power to power tools, and particularly to a method and system for emergency power cut off using radio frequency signals transmitted from a remote control.

BACKGROUND OF THE INVENTION

[0003] Power tools are expensive and can be dangerous. An operator may have a mishap in which the power tool inflicts an injury. The rotary, penetrating portion of a blade or bit may become stuck in the item being worked on. An object may fall onto the path of the blade or bit causing damage to the power tool. The power tool may otherwise malfunction. Current work platforms usually have a power off switch. However, this switch is usually too small or too inconveniently located to be reached in an emergency situation where the power to the tool must be immediately cut off.

[0004] Therefore, it would be desirable to provide a method and system for emergency power cut off to a power tool.

SUMMARY OF THE INVENTION

[0005] Accordingly, the present invention is directed to a method and system for providing an emergency power cut off to a power tool through wireless communications.

[0006] In a first aspect of the present invention, a method for emergency power shut off of a power tool includes the steps of actuating a foot pedal or a wearable switch, generating a signal as a result of the actuation, transmitting the signal as a radio frequency signal, receiving the radio frequency signal, and shutting off power to a power tool in response to the received radio frequency signal.

[0007] In a second aspect of the present invention, a system for providing an emergency power cut off to a power tool includes a power tool, a work platform to which is mounted the power tool, a receptacle mounted to the work platform for receiving power, a power cord bringing power to the receptacle at a first end of the power cord and plugging into a power outlet at a second end, and an switch device that transmits a radio frequency signal which causes power to be cut off from the power tool.

[0008] In a third aspect of the present invention, a method for wirelessly controlling power supplied to a power tool includes the steps of pressing against an actuator of a switch, generating a wireless signal in response to the pressing, propagating the wireless signal across a medium, interpreting the wireless signal, and stopping power from being supplied to a power tool in response to the interpreting.

[0009] In a fourth aspect of the present invention, a system for stopping power supplied to a power tool in an emergency includes a remote control issuing a wireless command signal upon activation by an operator, a receiver that receives the wireless command signal and transmits an electrical signal corresponding to the wireless command signal through an electrical conductor, and a controller that receives electrical signal and stops power from being supplied to the power tool in response to the received electrical signal.

[0010] It is to be understood that both the forgoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention as claimed. The accompanying drawings, which are incorporated in and

constitute a part of the specification, illustrate an embodiment of the invention and together with the general description, serve to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The numerous advantages of the present invention may be better understood by those skilled in the art by reference to the accompanying figures in which:

FIG. 1 illustrates a flowchart of an embodiment of the basic method steps of the present invention;

FIG. 2 illustrates a flowchart of an alternative embodiment of the transmission phase of the present invention;

FIG. 3 illustrates a flowchart of an embodiment of the receiver phase of the present invention;

FIG. 4 illustrates an embodiment of a system of the present invention;

FIG. 5 illustrates potential locations of the radio frequency receiver device of the present invention;

FIG. 6 illustrates an exemplary actuator device of the present invention;

FIG. 7 illustrates an exemplary transmitter circuit for the actuator of the present invention; and

FIG. 8 illustrates an exemplary receiver circuit of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0012] Reference will now be made in detail to the presently preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings.

[0013] The present invention relates to a method of emergency power cutoff for a power tool using wireless remote control and a system that uses this method. The remote control device may be worn by the operator, may be implemented as a foot pedal conveniently within reach of the operator's foot, or may be implemented in another manner as long as the remote control may generate and transmit an emergency cut off

power signal with minimal delay and minimal inconvenience. The wireless signal is preferably a radio frequency signal, but may be another type of wireless signal, such as infrared or acoustic. The wireless receiver device may be located at a power outlet, may be located at the power receptacle mounted on the work platform, may be mounted within a power or control box on the work platform, or may be otherwise suitably located.

[0014] FIG. 1 illustrates an embodiment 100 of a method of the present invention. The remote control, worn by an operator or implemented as a foot pedal, is activated by the operator 110. Preferably, the activation is performed by pressing a button because a simpler approach in an emergency situation is more likely to be followed. The manual activation causes a signal to be generated. This signal is encoded and transmitted as a wireless signal 120. The wireless signal passes through a medium, such as air, where it is sensed by a receiver. The received wireless signal is decoded 130. The process of encoding and decoding ensures that the wireless signal is the true signal and not a stray signal, such as a radio station signal, a television remote control signal, or a garage door opener signal. In response to a valid shut off command signal, the power to the power tool is shut off 140.

[0015] FIG. 2 illustrates an alternate embodiment 200 of the method employed with a remote control. The transmitter may be configured 210. Configuration may involve reloading software code into an internal processor or memory, setting a transmission pulse length, setting a level of transmission power, selecting options such as whether to send a signal to an external indicator or provide an alert to an external device, setting a range, identifying a receiver device by an address, identifying a receiver device by a serial number and revision number, and the like. The remote control is preferably worn by the operator or accessible with ease by the operator, such as by a conveniently located foot pedal 215. A determination is made as to whether manual activation has occurred 220. If not, a determination is made as to whether a condition has occurred within the

remote control device to warrant the transmission of a wireless signal 230. If not, the remote control may enter or remain in a low power mode 240. If activation has occurred, the signal is encoded 250 and transmitted 260.

[0016] FIG. 3 illustrates an embodiment 300 of the receiver in the method of the present invention. The wireless signal is received 310 and decoded 320. The command corresponding to the decoded signal is performed 330.

[0017] FIG. 4 illustrates an embodiment 400 of the use of the present invention. A table saw 470 is mounted on a work platform 460. A wireless sensor or receiver 420 is mounted on the work platform. The power to the table saw is controlled through a control device that includes or is coupled to the wireless sensor 420. An operator may install or carry the wireless remote control to various locations. Preferably, the remote control is portable. For example, the remote control 430 may be worn at the waist level. The remote control 430 may attach to the operator's belt or waistband of clothing by various mechanical attachments 425, such as a clasp to the operator's belt. Alternatively, the remote control 415 may be worn on the wrist of the operator by a Velcro strap or other removable wrist band. The remote control may also be worn on an operator's head. For example, the remote control may be incorporated in a helmet, a face shield, eye wear, or goggles. In another alternative, a foot pedal 440 may be used. The foot pedal may press against a button 450 when pressed against by an operator's foot. A spring return mechanism 445 may be used to maintain the foot pedal in a normally open (i.e., non-activated) position. An indicator 480 may be provided externally to the work platform and the operator to alert the operator to a pending condition or alert co-workers to an emergency. The indicator 480 may be a steady light, a flashing or strobe light, a buzzer, or the like.

[0018] FIG. 5 illustrates an embodiment 500 showing various placements of the receiver in the present invention. An alternating current (AC) power outlet 510 has one or more

receptacles 516. The AC power outlet may be 110 volts, 220 volts, or other useable voltage. Each receptacle has two or three slots or holes 514 to accept the prongs of a power cord 522, 524. A receiver 530 may be directly inserted into the receptacle 516 of the power outlet 510. Then, the power cord input connector may be inserted into the receiver 530. Alternatively, the power cord output connector may connect to the receiver 540 through prongs or pins 505. The receiver 540 may then attach to connector 560 located on the work platform. In another alternative, the receiver 570 is installed on or within a housing 550 through which the power supply lines to the power tool pass. The housing may also contain a power supply controller. The receiver and power supply controller may be housed separately.

[0019] FIG. 6 illustrates an exemplary embodiment 600 of a remote control 430. The housing 640 of the remote control may be made of plastic or other suitable material. An activation button or switch 610 is conveniently located on the housing 640. Ideally, the button 610 is large enough and conveniently located to maximize the chances that an operator may activate the button under extreme circumstances, but inaccessible enough so the operator cannot inadvertently activate the button under normal working conditions. The remote control 430 has a power source such as a battery. An indicator light 620 on the remote control 430 may be provided to notify the operator of low battery conditions. Control elements 630 may be placed on the remote control 430 to change characteristics such as the length and intensity of the wireless signal pulse. The control elements 630 may include enablement or disablement of certain functions, such as providing a signal to an external alert mechanism. Control elements 630 may be rotary knobs or push button switches. In an embodiment, the remote control may be implemented to vibrate under certain conditions.

[0020] FIG. 7 illustrates an exemplary embodiment 700 of the transmission circuitry of the remote control 430. The button or switch 610 may be represented by the switch 740. When the button is pressed, a change of voltage level is presented to a processor 710. A

normally closed switch may be used instead of the normally open switch that has been illustrated. Instead of a manually activated switch, a switch may be used which is activated when not substantially oriented in a certain direction; for example, a switch may be activated when the wearer of the remote control is not in a substantially upright position. The processor 710 may be a PIC or other microprocessor. Software code may be downloaded onto the microprocessor to perform the functions of the remote control. The processor 710 provides a signal to the encoder 720 that then provides an encoded signal to the antenna 730. Alternatively, an infrared light emitting diode may be used for infrared communications. Booster circuitry may be incorporated as needed or desired; for example, a booster transistor may be used to supply greater current to the antenna 730. The power source of the remote control is preferably a battery 750. The remote control also may have a battery backup. A low battery detector circuit may be provided. In an example of a low battery detector circuit, a voltage divider formed of two resistors 760 and 765 provides a voltage to the base (or gate) of a transistor 775. Either or both resistors 760 and 765 may be made variable to adjust the voltage applied to the base. When the base voltage drops below a threshold because the voltage provided by the power source 750 decreases, the transistor 775 is turned on. This causes a current to flow through the indicator 770. If the indicator 770 is a light emitting diode, the current flow turns the indicator light on. The diode 780 is used to isolate the battery 750 from an electrolytic capacitor 755. The electrolytic capacitor helps to supply sufficient current to the indicator 770 when the battery 750 grows too weak.

[0021] FIG. 8 illustrates an exemplary embodiment 800 of a receiver of the present invention. An antenna 810 receives a radio frequency signal. The antenna 810 may be coupled to a receiver module that provides a signal to the processor 830. The radio frequency signal is decoded 820. A processor 830 determines the command associated with the signal. A power cut off command may be transmitted directly to a switch 860 to cut off the power supplied to a power tool. Alternatively, the power cut off command may be latched by a latch 840 that then controls the actuator of the cut off switch. As

shown in FIG. 8, another switch 850 may determine whether a latched control signal, a momentary signal, or a signal of limited duration is applied to the switch 860. The signal selection made by switch 850 may be set manually by a DIP switch or may be set through the processor 830. The switch 850 may be opened automatically or may be limited to manual release only. Various glue logic, booster circuits, protective circuits, and the like are contemplated by the present invention.

[0022] It is believed that the present invention and many of its attendant advantages will be understood by the forgoing description. It is also believed that it will be apparent that various changes may be made in the form, construction and arrangement of the components thereof without departing from the scope and spirit of the invention or without sacrificing all of its material advantages. The form herein before described is merely an explanatory embodiment thereof. It is the intention of the following claims to encompass and include such changes.